



Per- and Polyfluoroalkyl Substances (PFAS)

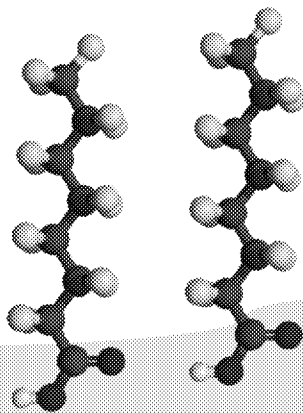
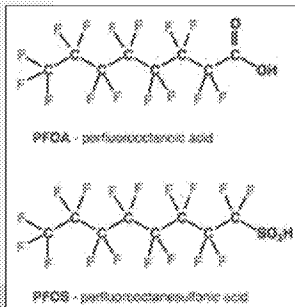
November 29, 2017

Tom Sinks Ph.D., Director, Office of the Science Advisor

- What are Per- and Polyfluoroalkyl Substances (PFAS)?
- How are PFAS used?
- PFAS and Children
- What is EPA doing about it?
- Example: PFAS in North Carolina



Perfluorinated Compounds (PFC) / Perfluoroalkyl Substances (PFAS)



➤ A class of man-made chemicals

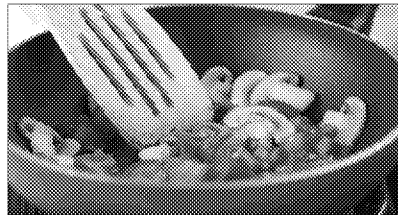
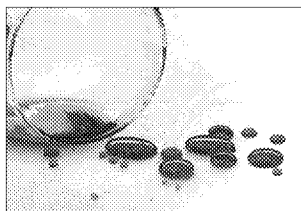
- Chains of carbon atoms surrounded by fluorine atoms
- Some PFAS include oxygen, hydrogen, sulfur and/or nitrogen atoms, creating a polar end
- Shorter chain PFAS tend to be highly mobile, longer chain PFAS less mobile

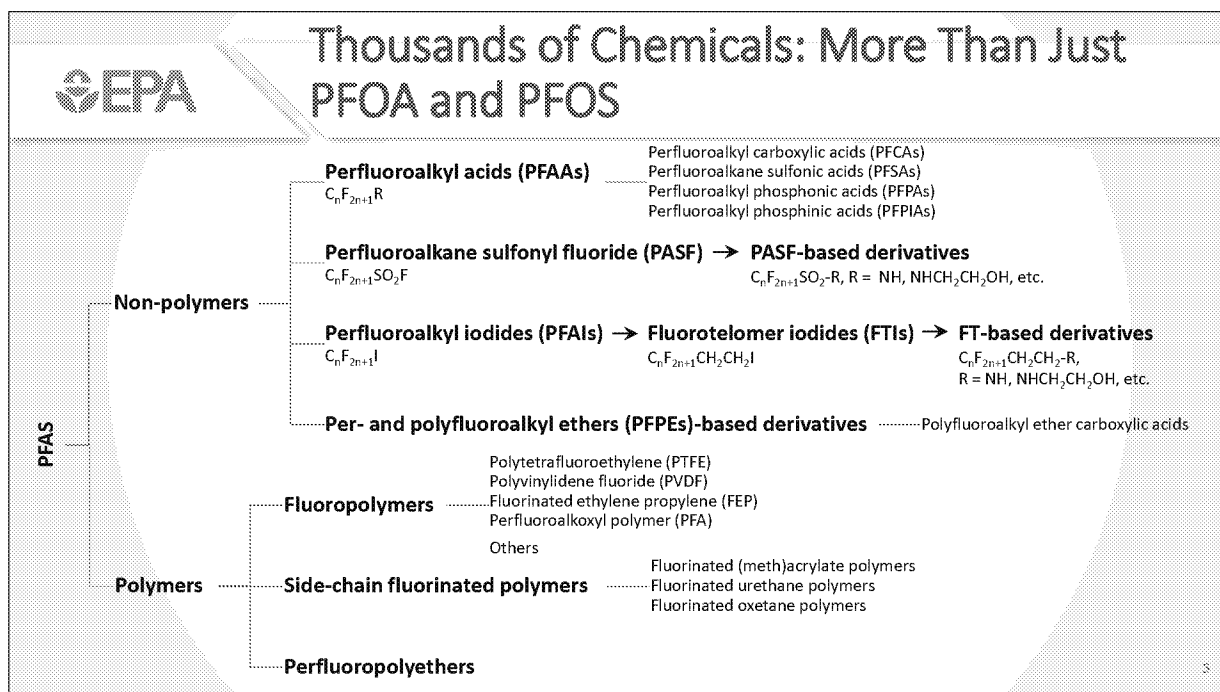
(Susan to insert graphic)

Perfluorinated Compounds (PFC) / Perfluoroalkyl Substances (PFAS)

➤ They are of concern

- Known or suspected toxicity, notably for PFOA and PFOS
- Resist decomposition in the environment and in human bodies
- Used by a variety of industries
- Found in a variety of consumer products
- Most people have been exposed to PFAS





PFOA = perfluorooctanoic acid – PFCA

PFOS = perfluorooctanesulfonate – conjugate base of PFSA

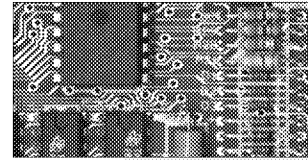
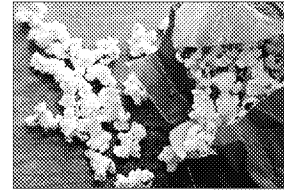
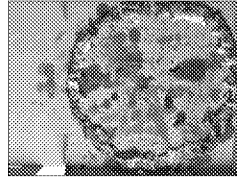
“Per” = fully fluorinated

“Poly” = many fluorines

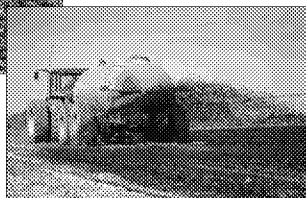


PFAS Used Daily in Homes, Businesses, and Industry

- Food contact surfaces such as cookware,¹ pizza boxes, fast food wrappers, popcorn bags, etc.
- Polishes, waxes, and paints
- Stain repellants for carpets, clothing, upholstered furniture, etc.
- Cleaning products
- Dust suppression for chrome plating
- Electronics manufacturing
- Fuel cell manufacturing
- Oil and mining for enhanced recovery
- Performance chemicals such as hydraulic fluid, fuel additives, etc.



Deliberative Process / Ex. 5



- Direct release of PFAS or PFAS products into the environment
 - Use of aqueous film forming foam (AFFF) in training and emergency response
 - Release from industrial facility
- Landfills and leachates from disposal of consumer and industrial products containing PFAS
- Land where wastewater treatment plant biosolids was applied



PFAS – Health Effects

Adverse effects observed following exposures to PFOA and PFOS are the same or similar and include effects in humans on serum lipids, birth weight, and serum antibodies. Some animal studies show common effects on the liver, neonate development, and responses to immunological challenges. Both compounds were also associated with tumors in long-term animal studies.

Source: EPA PFOA/PFOS Health Advisory

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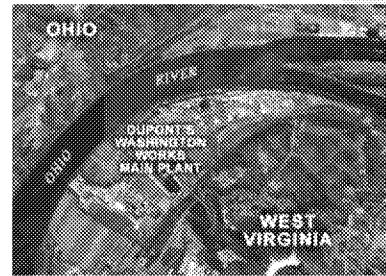


PFAS and Children (1)

Blood Serum Levels for 69,030 Current and Former Residents of Six Water Districts in the Mid-Ohio Valley (2005–2006)

Age (years)	N	Median perfluorooctanoic acid (PFOA) level (ng/mL)
0–9	4,915	32.8
10–19	9,658	26.6
20–29	10,073	21.0
30–39	10,547	22.7
40–49	12,113	28.0
50–59	10,515	33.6
60–69	6,881	42.9
≥70	4,328	40.1

Source: Steenland et al. 2009



The median serum (ng/mL) PFOA level for US Population		
	2005-2006	2013-2014
12 to 19 yo	3.80 (3.30-4.20)	1.67 (1.37-1.97)
20 yo +	4.20 (3.80-4.60)	2.07 (1.90-2.27)

Source: CDC NHANES

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PFAS and Children (2)



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta, GA 30333

February 10, 2009

Because of concerns for potential adverse effects in vulnerable groups, persons such as pregnant women, women of child-bearing age, children, and the elderly living in the vicinity of the Washington Works Facility should reduce local water exposures to levels that are as low as reasonably achievable.

In addition, ATSDR concurs with previous verbal advice given by the West Virginia Department of Public Health; that it is prudent public health practice for caregivers in the area near the Washington Works Facility to reduce drinking water exposures

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EPA's Current PFAS Activities

Issues related to PFAS involve most EPA Programs and Regions. Four broad goals:

- Addressing public concerns and informing risk mitigation by filling data gaps related to human health toxicity;
- Establishing validated methods for measuring the amount of PFAS in different environmental media and for biomonitoring;
- Reducing PFAS exposures by limiting production of potentially hazardous PFAS and by assisting states and federal partners in the remediation of environmental media;
- Improving risk communication efforts to ensure the accurate and timely communication of information to the public and other partners (e.g. local governments, tribes, industry).



Current PFAS Activities: Office of Water

- From 2013 to 2015, EPA collected nationally representative data on the occurrence of six PFAS in public water systems (including PFOA and PFOS) – Minimum Reporting Level (MRL) of 0.04 ug/L.

Public Water Systems sampled	Samples collected	PWS at or above the MRL	PWS at or above 0.07 ug/L PFOA+PFOS
5,000 serving > 10,000 people and 800 small systems	36,000 from 4,800 PWS	2%	1%

- **Published Drinking Water Health Advisories (HA) in 2016 for PFOA and PFOS**
 - HAs are non-regulatory information for federal, state and local officials to consider when addressing drinking water contamination
 - Identified 0.07 µg/L (70 parts per trillion) as the HA level for PFOA and PFOS combined and provided information about treatment and monitoring
 - HA based on a reference dose (RfD) derived from a developmental toxicity study in mice; the critical effects included reduced ossification in proximal phalanges and accelerated puberty in male pups following exposure during gestation and lactation.

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Current PFAS Activities Office of Water

➤ Evaluating PFOA and PFOS for regulatory determination under the Safe Drinking Water Act (SDWA)

PFOA and PFOS are on the fourth Contaminant Candidate List (CCL 4) published in November 2016. OW is assessing PFOA and PFOS against the three SDWA regulatory determination criteria

-May have an adverse effect on the health of persons

-Is known to occur or there is a substantial likelihood that it will occur in public water systems with a frequency and at levels of public health concern

-In the sole judgment of the Administrator, regulating the contaminant presents a meaningful opportunity for health risk reductions for persons served by public water systems

➤ EPA must decide whether or not to regulate at least five CCL4 contaminants by January 2021



Current PFAS Activities: Office of Land and Emergency Management

➤ **EPA Federal Facility Superfund Program**

- Program is actively engaged in a PFAS cleanup process at 32 Federal Facility National Priorities List (NPL) sites
- It is anticipated that this number will grow since there are known or suspected contaminations of PFAS at many of the 80 DOD Federal Facility NPL Sites
- PFAS detections in groundwater range from non-detect (based on analytical method limitations) or slightly exceeding the Drinking Water Health Advisory of 70 parts per trillion (ppt; PFOA and PFOS combined) to 2,000,000 ppt
- Drinking water has been impacted at 17 of these Federal Facility NPL sites

➤ **Office of Superfund Remediation and Technology Innovation (OSRTI)**

- 15 known impacted non-Federal NPL sites
- 100s of potential NPL sites (e.g. 100 metal plating sites, 300 landfills)

➤ **Regional Assistance**

- Holding site-specific consultations with EPA Regions on investigations of PFAS contamination



Current PFAS Activities: Office of Chemical Safety and Pollution Prevention

- **PFOA Stewardship Program**
 - Eight companies participated in the program and successfully eliminated production of PFOA
 - Resulted in phase-out of PFOA and related PFAS, including potential PFOA precursors, by these companies by the end of 2015.
- **EPA's New Chemicals Program**
 - Since 2000 have reviewed hundreds of pre-market alternatives for PFOA and related chemicals. Most were approved with restrictions and data-generation requirements.
- **Significant New Use Rule (SNUR)**
 - Proposed on January 21, 2015, to require manufacturers, importers, and processors of PFOA and related chemicals (including as part of articles), to notify EPA at least 90 days before starting or resuming new uses of these chemicals in any products
 - Notification provides EPA opportunity to conduct risk assessment/management for the new use
- **GenX**

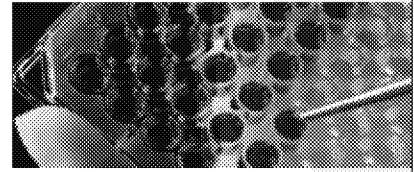
Deliberative Process / Ex. 5



Current PFAS Activities: Office of Research and Development

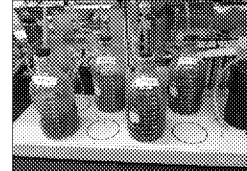
➤ **Human Toxicity**

- Understand human health toxicity
- Inform risk mitigation activities
- Chemical library and high throughput toxicity testing



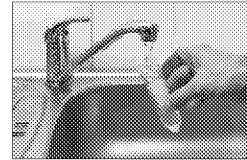
➤ **Laboratory Methods**

- Establish validated laboratory methods for measuring PFAS in different environmental media



➤ **Drinking Water Treatment and Site Remediation**

- Reduce PFAS exposures
- Identify human exposures
- Treat and remediate drinking water and contaminated sites



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Technical Support to North Carolina: EPA Office of Research and Development

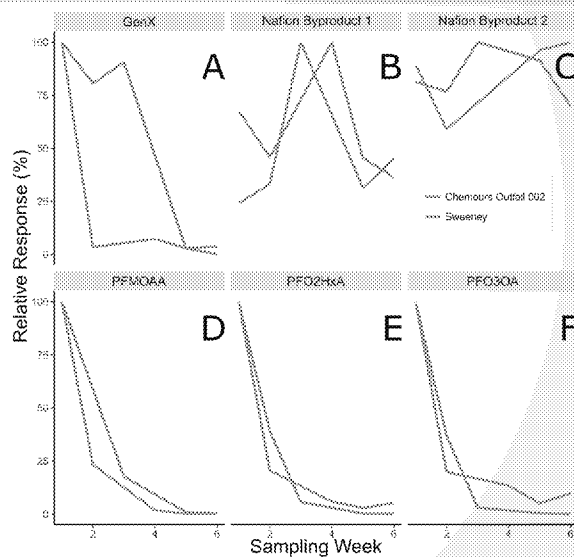
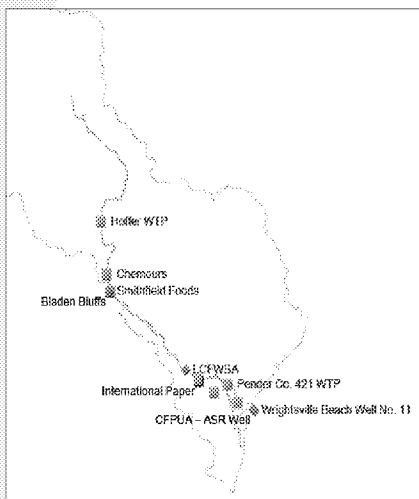
- EPA ORD, in collaboration with North Carolina State University, has been conducting PFAS research in the Cape Fear River for the last 10 years
- Recent work, based on non-targeted analysis, identified a range of new PFAS chemicals (~15), including Gen X and Nafion byproducts in Cape Fear and drinking water
- GenX was measured in drinking water
 - Mean concentration of 631 ng/L
 - Local press picked up on the published results
- North Carolina Department of Environmental Quality (NC DEQ), EPA Region 4, and EPA Research partnered to monitor the effectiveness of source remediation
- NC DEQ, in consultation with EPA, established a Health Goal for GenX in drinking water (140 ng/L)
- NC DEQ conducted sampling in Cape Fear over 8 weeks at 13 locations
- EPA Research analyzed samples and provided reports to NC DEQ, including GenX results
- NC DEQ and EPA established that GenX levels in drinking water fell below the Health Goal

More States are requesting EPA technical support for contaminated sites

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PFAS in North Carolina





On-going sampling revealed ...

Raleigh, NC November 14, 2017

North Carolina Department of Environmental Quality issues violation notice to Chemours for unreported chemical spill ...

- The N.C. Department of Environmental Quality has cited Chemours with violating the conditions of its wastewater discharge permit because the company failed to report an Oct. 6 chemical spill at its Fayetteville Works facility.
- DEQ questioned Chemours officials in early November after receiving preliminary data from water samples the state agency collected that indicated elevated concentrations of GenX at Chemours' primary wastewater discharge outfall.
- After being questioned by DEQ, the company admitted to DEQ that a spill had occurred four weeks earlier on Oct. 6 from a manufacturing line at the Chemours facility. The company told state officials that dimer acid fluoride, a precursor to GenX, had spilled.